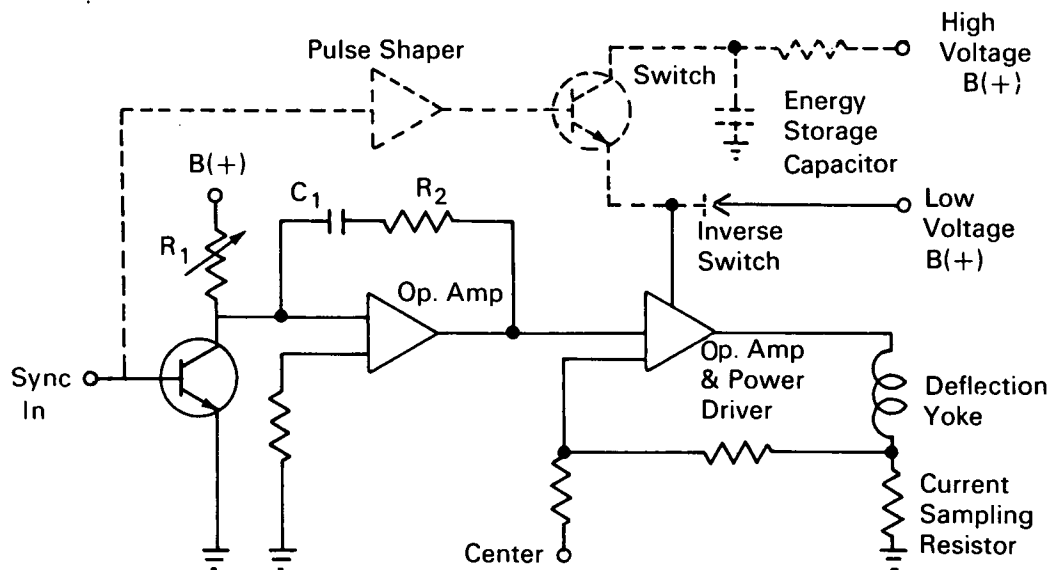


NASA TECH BRIEF



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High Efficiency, High Frequency Magnetic Deflection Driver



Many light sensitive vacuum tubes, both display and sensor, use electromagnetic fields to deflect the electron beam into the required raster. Electromagnetic deflection can be done with volts or tens of volts rather than the hundreds of volts required for electrostatic deflection (20,000 volt devices are common), and is thus becoming more popular with the appearance of transistors and integrated circuits in the television field.

The electromagnetic yoke is, however, an energy storage device which stores energy during the scan and releases it in the flyback or retrace. This flyback time is typically 5% to 20% of the total sweep time and thus the flyback voltage is 5 to 20 times the voltage required for the scan. This technique involves a method of switching to a voltage high enough to dissipate the flyback pulse during the retrace time

and then operating during the scan time at a much lower voltage. With the improvement, the high voltage has a low duty cycle and since this occurs when the yoke is supplying energy to the circuit, the high voltage power dissipation is small and can usually be supplied by the imaging tube accelerator voltages.

An ideal circuit design would require only $IR/2$ volts from one supply and $L di/dt$ (flyback) + $L di/dt$ (scan) + $IR/2$ volts from the other supply. Thus, if the $L di/dt$ (flyback) voltage is supplied only during the flyback period and the $L di/dt$ (scan) + $IR/2$ is supplied the rest of the time, the power dissipation is reduced by a factor of 20 or better ($(L di/dt \text{ (flyback)}) / (L di/dt \text{ (scan)})$ ratio) during the scan time.

The figure shows a block diagram of a typical driven sweep with the unique features of this technique added in dashed lines. Using the operational amplifier

(continued overleaf),

as an integrator, the sawtooth is determined by $B(+)$, R_1 , and C_1 while the step is determined by the drop across R_2 . The output stages combine a complementary pair for efficiency with negative feedback into another operational amplifier to provide linearity, stability, and a convenient centering control. The practical circuit demonstrates an obvious improvement in power dissipation over the commercial units. The low voltage power supplies are not optimized to the chosen yoke, so a further improvement of at least 2:1 in power dissipation could be realized.

Notes:

1. This disclosure claims the general idea of switching to a higher supply voltage during the "retrace" time as a means of (a) reducing power consumption, (b) eliminating the need of a special high voltage, high current power supply, and (c) reduction of cost due to the use of lower power devices.

2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer
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Houston, Texas 77058
Reference: B68-10116

Patent status:

No Patent action is contemplated by NASA.

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